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DIVISION 02 - SITE CONSTRUCTION

SECTION 02747

ASPHALTIC CONCRETE SURFACE COURSE

06/04

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA-02747 (June 2004)
NASA
Superseding NASA-02747
(May 2004)

SECTION 02747

ASPHALTIC CONCRETE SURFACE COURSE
06/04

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers central-plant hot-mix bituminous concrete base and surface courses for roads, streets, and similar-use areas, constructed to the grades and cross section indicated over a prepared base course specified below.

Select the following sections for inclusion with this section:

Section 02715, "Limerock Base Course"

Drawings shall indicate plan of bituminous-concrete paving, grades, and pavement cross section showing the thickness, after compaction, of the aggregate base course, bituminous-concrete base course, and bituminous-concrete surface course.

Specifier should review the Intermodal Surface Transportation Efficiency Act of 1991 for recommendations on recycling of scrap rubber tires into asphalt mixes. References: U.S. Code Congressional and Administrative News, ASTM D 2000 ASTM D 1566, ASTM D 3515, and AI MS 2.

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 247	(2002) Glass Beads Used in Traffic Paints
AASHTO M 248	(1991; R 2000) Ready-Mixed White and Yellow Traffic Paints
AASHTO T 166	(2000) Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
AASHTO T 176	(2002) Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
AASHTO T 2	(2000) Sampling of Aggregates
AASHTO T 30	(1993; R 1998) Mechanical Analysis of Extracted Aggregate
AASHTO T 37	(2001) Sieve Analysis of Mineral Filler for Road and Paving Materials

ASPHALT INSTITUTE (AI)

AI MS-02	(1997; 6th Ed) Mix Design Methods for Asphalt
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ASTM INTERNATIONAL (ASTM)

ASTM C 127	(2001) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C 128	(2001e1) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C 131	(2003) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(2001) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 88	(1999a) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 1073	(2001) Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D 113	(1999) Standard Test Method for Ductility of Bituminous Materials
ASTM D 1754	(1997; R 2002) Standard Test Method for Effect of Heat and Air on Asphaltic

Materials (Thin-Film Oven Test)

ASTM D 1856	(1995a; R 2003) Test Method for Recovery of Asphalt from Solution by Abson Method
ASTM D 2027	(1997; R 2004) Standard Specification for Cutback Asphalt (Medium-Curing Type)
ASTM D 2028	(1997; R 2004) Standard Specification for Cutback Asphalt (Rapid-Curing Type)
ASTM D 2041	(2003a) Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2170	(2001a) Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens) IP Designation: 319/84 (89)
ASTM D 2172	(2001e1) Standard Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 242	(1995; R 2000; E 2001) Standard Specification for Mineral Filler for Bituminous Paving Mixtures
ASTM D 3176	(1989; R 2002) Standard Practice for Ultimate Analysis of Coal and Coke
ASTM D 3180	(1989; R 2002) Standard Practice for Calculating Coal and Coke Analyses from As-Determined to Different Bases
ASTM D 4	(1986; R 1998) Standard Test Method for Bitumen Content
ASTM D 5	(1997) Standard Test Method for Penetration of Bituminous Materials
ASTM D 5581	(1996; R 2001) Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 Inch-Diameter Specimen)
ASTM D 692	(2000) Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
ASTM D 70	(2003) Standard Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)
ASTM D 854	(2002) Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer
ASTM D 92	(2002b) Standard Test Method for Flash and Fire Points by Cleveland Open Cup
ASTM D 946	(1982; R 1999) Standard Specification for

Penetration-Graded Asphalt Cement for Use
in Pavement Construction

ASTM D 979

(2001) Standard Practice for Sampling
Bituminous Paving Mixtures

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

DOT

(2000; R1) Federal Highway Administration
Publication: Manual on Uniform Traffic
Control Devices (MUTCD) for Streets and
Highways

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions
in Section 01330, "Submittal Procedures," and edit
the following list to reflect only the submittals
required for the project. Submittals should be kept
to the minimum required for adequate quality
control. Include a columnar list of appropriate
products and tests beneath each submittal
description.

The following shall be submitted in accordance with Section 01330,
"Submittal Procedures," in sufficient detail to show full compliance with
the specification:

SD-03 Product Data

Design analysis and calculations for Bituminous Concrete Mixture
shall be submitted in accordance with the paragraph entitled,
"Performance Requirements," of this section.

Manufacturer's Catalog Data shall be submitted showing description
for the following items:

Paint
Reflective Beads

SD-04 Samples

The following samples shall be submitted:

Proposed Bituminous Concrete Materials
Proposed Bituminous Concrete Mixture
White Paint
Yellow Paint
Reflective Beads (500 grams)

SD-05 Design Data

Mix Designs (Contractor and Job) for each Bituminous Concrete
Mixture shall be submitted.

SD-06 Test Reports

Test reports for the following items shall be submitted in accordance with the paragraph entitled, "Quality-Control Testing During Construction," of this section:

Uncompacted Bituminous Concrete Mix
Compacted Bituminous Concrete Mix
In-Place Pavement

SD-07 Certificates

Prior to construction start, the construction equipment list shall be certified by the Contractor and submitted for approval.

Certificates of compliance for the following items shall be submitted in accordance with the applicable reference standards and descriptions contained within this section:

Coarse Aggregate
Fine Aggregate
Mineral Filler
Asphalt Cement
Bituminous Concrete Mixture
Bituminous Tack Coat
Paint
Reflective Beads

1.3 PROTECTION OF PERSONS AND PROPERTY

Paving operations shall be conducted in a manner that will ensure the safety of persons and property.

1.4 MAINTAINING TRAFFIC

Vehicular and pedestrian traffic shall be maintained in accordance with DOT, Part II, during the construction of the work by keeping open vehicular traffic lanes or by providing detour routes.

Traffic lanes and detour routes shall be barricaded and posted with warning signs for safety and directing traffic. Warning lights shall be provided during hours of darkness, in accordance with DOT.

1.5 SAMPLING AND TESTING

**NOTE: When 200 tons 550 cubic meter or less of
bituminous-concrete mix are required, test
requirements must be reviewed.**

1.5.1 Testing and Inspection

A bituminous-concrete testing and inspection service shall be provided by the Contractor. Testing service shall be approved and shall include sampling and testing bituminous-concrete materials proposed for use in the work, tests and calculations for bituminous concrete mixture, and field-testing facilities for quality control during construction of bituminous-concrete courses.

1.5.2 Tests for Proposed Bituminous Concrete Materials

Bituminous-concrete materials proposed for use in the work shall be sampled and tested as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Coarse and fine aggregates	Sampling	AASHTO T 2	One for each material
	Sieve analysis	ASTM C 136	
	Magnesium Sulfate Soundness Test	ASTM C 88	
	Sand Equivalent Test of fine aggregate	AASHTO T 176	
	Resistance to abrasion of small size coarse aggregate	ASTM C 131	
Mineral Filler	Sieve analysis	AASHTO T 37	One for each source of material
Asphalt cement	Penetration	ASTM D 5	One for each specified penetration grade
	Flash point	ASTM D 2170 ASTM D 92	
	Ductility	ASTM D 113	
	Loss on heating	ASTM D 1754	
	Solubility	ASTM D 4, Procedure No. 1	
	Ash	ASTM D 3176 ASTM D 3180	

1.5.3 Tests for Bituminous Concrete Mixture

Job-mix formula for each Bituminous Concrete Mixture proposed for use in the work shall be tested as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Compacted bituminous-concrete mix	Bulk density	AASHTO T 166	Four for each bituminous-concrete mixture
	Marshall Stability Test	ASTM D 5581	
Aggregate and asphalt cement	Specific gravity of coarse aggregate	ASTM C 127	One for each material

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
	Specific gravity of fine aggregate	ASTM C 128	
	Apparent specific gravity of mineral filler	ASTM D 854	
	Apparent specific gravity of asphalt cement	ASTM D 70	
Uncompacted bituminous-concrete mix	Maximum theoretical specific gravity	ASTM D 2041	Two for each bituminous-concrete mixture

A density and voids analysis shall be calculated for each series of bituminous-concrete mixture test specimens in conformance with AI MS-02 and shall include the quantity of absorbed asphalt cement in pounds kilogram of dry aggregate, percent of air voids, and percent of voids in mineral aggregate.

Report of each job-mix formula shall be submitted on the form entitled, "Hot-Mix Design Data by the Marshall Method" as shown in AI MS-02.

1.5.4 Quality-Control Testing During Construction

Test reports for Uncompacted Bituminous Concrete Mix, Compacted Bituminous Concrete Mix and In-Place Pavement shall be submitted in accordance with this paragraph.

Bituminous-concrete mixtures shall be sampled and tested for quality control during construction of the bituminous-concrete courses as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Uncompacted bituminous-concrete mix	Sampling	ASTM D 979	One test for each 400 tons, or fraction thereof, of each mixture taken at the mixing plant
	Asphalt cement content	ASTM D 2172	
	Mechanical analysis extracted aggregates	AASHTO T 30	
	Recovery of asphalt cement by Abson Method	ASTM D 1856	
	Penetration of recovered asphalt cement	ASTM D 5	
	Ductility of recovered asphalt	ASTM D 113	

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
	cement		
Compacted bituminous-concrete Marshall samples	Bulk density Marshall Stability and Flow Tests	AASHTO T 166 ASTM D 5581	Same as specified for uncompacted mix
In-place pavement	Density and thickness	As specified	One specimen for each 500 square yards of completed bituminous-concrete course

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Uncompacted bituminous-concrete mix	Sampling Asphalt cement content Mechanical analysis extracted aggregates Recovery of asphalt cement by Abson Method Penetration of recovered asphalt cement Ductility of recovered asphalt cement	ASTM D 979 ASTM D 2172 AASHTO T 30 ASTM D 1856 ASTM D 5 ASTM D 113	One test for each 1200 cubic meter, or fraction thereof, of each mixture taken at the mixing plant
Compacted bituminous-concrete Marshall samples	Bulk density Marshall Stability and Flow Tests	AASHTO T 166 ASTM D 5581	Same as specified for uncompacted mix
In-place pavement	Density and thickness	As specified	One specimen for each 420 square meter of completed bituminous-concrete course

Test results shall be reported in writing on the same day that tests are made.

A bituminous-concrete mixture that does not meet the requirements specified shall not be used in the specified work.

1.5.5 Field Testing Facilities at the Mixing Plant

Field-testing facilities for testing bituminous-concrete materials and mixes at the bituminous mixing plant shall be provided by the testing service.

1.6 CONSTRUCTION EQUIPMENT LIST

Construction equipment list for all major equipment used for transporting, spreading and finishing shall be submitted to the Contracting Officer prior to construction.

PART 2 PRODUCTS

2.1 AGGREGATE FOR BITUMINOUS-CONCRETE

Coarse Aggregate shall conform to ASTM D 692.

Fine Aggregate shall conform to ASTM D 1073. The sand equivalent value shall be not less than 30.

2.2 MINERAL FILLER

Mineral filler for bituminous paving mixtures shall conform to ASTM D 242.

2.3 ASPHALT CEMENT

Cement shall conform to ASTM D 946, Penetration Grade [60-70.] [85-100.] [120-150.]

2.4 BITUMINOUS PRIME COAT

Bituminous prime coat shall be medium-curing cut-back asphalt conforming to ASTM D 2027, designation MC-70 or MC-250.

2.5 BITUMINOUS TACK COAT

Bituminous tack coat shall be rapid-curing cut-back asphalt conforming to ASTM D 2028, designation RC-70.

2.6 COMPOSITION OF BITUMINOUS-CONCRETE MIXTURES

2.6.1 Bituminous-Concrete Mixtures

Bituminous Concrete Mixture shall be submitted for approval.

2.6.2 Job-Mix Formulas

A job-mix formula for each bituminous-concrete mixture proposed for use in the work shall be submitted for approval prior to the start of the work.

Each job-mix formula shall be within the limits specified for the particular type of bituminous-concrete mixture. Each job-mix formula shall establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to the aggregate, and a single temperature at which the bituminous-concrete mixture is to be produced.

Maximum permitted variation from the job-mix formula, within the limits specified for the type of bituminous-concrete mixture, shall be as follows:

Aggregate passing a No. 4 sieve or larger	7 percent
Aggregate passing No. 8, 30, 50, and 100 sieves	4 percent
Aggregate passing No. 200 sieve	8 percent
Asphalt cement	0.4 percent
Temperature of mixing	200 degrees F
Aggregate passing a 4.75 millimeter or larger	7 percent
Aggregate passing 2.36 millimeter and 600, 300 and 150 micrometer sieves	4 percent
Aggregate passing 75 micrometer sieve	2 percent
Asphalt cement	0.4 percent
Temperature of mixing	93 degrees C

2.7 PERFORMANCE REQUIREMENTS

Bituminous-Concrete Mixture shall meet the performance requirements described when sampled and tested; calculations shall be made for density and voids analyses as specified.

<u>TEST PROPERTY</u>	<u>BASE COURSE</u>	<u>SURFACE COURSE</u>
Number of compaction blows, each end of specimen	50	50
Marshall stability, pounds	500 minimum	500 minimum
Marshall flow, 1/100-inch units	8 minimum 18 maximum	8 minimum 18 maximum
Percent air void	3 minimum 8 maximum	3 minimum 5 maximum
Percent of voids in mineral aggregate	14 minimum	16 minimum
<u>TEST PROPERTY</u>	<u>BASE COURSE</u>	<u>SURFACE COURSE</u>
Number of compaction blows, each end of specimen	50	50
Marshall stability, kilogram	500 minimum	500 minimum
Marshall flow, millimeter units	8 minimum 18 maximum	8 minimum 18 maximum

<u>TEST PROPERTY</u>	<u>BASE COURSE</u>	<u>SURFACE COURSE</u>
Percent air void	3 minimum 8 maximum	3 minimum 5 maximum
Percent of voids in mineral aggregate	14 minimum	16 minimum

Asphalt cement used in the bituminous-concrete mixture, when extracted and recovered as specified, shall have the following test properties:

Penetration shall be less than 45.

Ductility at 77 degrees F 25 degrees C shall be not less than 24 inches 600 millimeter.

2.8 PAVEMENT MARKING

[Submit samples of White Paint, Yellow Paint and Reflective Beads (500 Grams) in one quart containers, unless otherwise noted.]

2.8.1 Paint

Paint shall conform to AASHTO M 248, Type [S] [____], and DOT, Part III. Parking lanes and crosswalks shall conform to standards of DOT, Part III.

2.8.2 Reflective Beads

Glass beads for reflectorized paint shall conform to AASHTO M 247, Type 1.

PART 3 EXECUTION

3.1 WEATHER LIMITATIONS

Bituminous prime and tack coats shall be applied only when the ambient temperature in the shade is above 50 degrees F 10 degrees C, when the temperature has not been below 35 degrees F 2 degrees C for 12 hours immediately prior to application, and when the aggregate base course is dry or contains moisture not in excess of the amount that will permit uniform distribution and the required penetration.

Bituminous-concrete courses shall be constructed only when the ambient temperature is above 40 degrees F 4 degrees C and the underlying base course is dry.

3.2 GRADE CONTROL

During construction, the lines and grades, including crown and cross-slope indicated for each pavement course, shall be established and maintained by means of line and grade stakes.

3.3 EQUIPMENT

All equipment shall be suitable for the purpose intended and shall be operated in such a manner that when completed, the bituminous-concrete pavement is as specified.

3.3.1 Storage

Components of the various-sized aggregates that are to be blended in the preparation of each bituminous-concrete mixture shall be placed in separate stockpiles in such a manner that the separate aggregate sizes will not be intermixed and segregation of the separate stockpiles will not occur.

Dry storage shall be provided for mineral filler.

3.3.2 Preparation of Asphalt Cement

Asphalt shall be heated at the mixing plant to a viscosity at which it can be properly handled through the pumping system and uniformly distributed throughout the bituminous-concrete mixture.

3.3.3 Preparation of Aggregates

Each size of aggregate shall be separately fed to the cold elevator in a manner that will produce an aggregate graded within the requirements of the job-mix formula and at a rate to permit correct and uniform temperature control of the heating and drying operation.

Aggregates shall be dried and delivered to the mixer at a temperature between 250 and 325 degrees F 121 and 163 degrees C. Temperature between these limits shall be regulated according to the penetration grade and viscosity characteristics of the asphalt cement, the temperature of the atmosphere, and the workability of the bituminous-concrete mixture.

Aggregates in the hot bins shall not contain sufficient moisture to cause the bituminous-concrete mixture to foam, slump, or segregate during hauling and placing operations.

If the dried aggregates are placed into more than one bin, they shall be screened and recombined into a gradation meeting the requirements of the job-mix formula.

3.3.4 Preparation of Mixture

Dried aggregates shall be accurately weighed or measured and conveyed to the mixer in the proportionate amounts of each aggregate size required to conform to the job-mix formula. Asphalt cement shall be weighed or metered and introduced into the mixer in the amount required by the job-mix formula.

Asphalt cement and aggregate introduced into the mixer shall be within 68 degrees F 20 degrees C of each other and at a temperature that will produce a bituminous-concrete mixture within the requirements of the job-mix formula. However, in no case shall the temperature of the asphalt cement exceed 300 degrees F 150 degrees C at the time of introduction into the mixer.

In batch-mixing plants, the aggregates shall be mixed dry for a period of not less than 10 seconds. Asphalt cement shall be added in an evenly spread sheet over the full length of the mixer box, except that in continuous-mixing plants the asphalt cement shall be spread evenly across the mixer box. After the asphalt cement has been introduced to the aggregates, the mixing shall be continued for a period of not less than 30 seconds nor more than 75 seconds. Length of the dry-mixing and wet-mixing period may vary, but under no circumstances shall the total mixing time or interval of time between the opening of the weight-box gate and the opening

of the mixer gate be less than 45 seconds.

3.3.5 Transportation of Mixtures

Bituminous-concrete mixtures shall be transported from the mixing plant to the project site in trucks having tight, clean, smooth beds that have been coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of the mixture to the truck beds.

Each load of mixture shall be covered with canvas or other suitable material of sufficient size and weight to protect the mixture from the weather and to retard loss of heat.

In cool weather or for long hauls, the entire contact area of each truck bed shall be insulated and covers shall be securely fastened.

Deliveries of the mixture shall be so scheduled that the placing and compaction can be completed during daylight unless satisfactory artificial light is provided.

Mixture shall be delivered in a such manner that the temperature of the mixture at the time of dumping into the paver will be not less than 235 degrees F 115 degrees C.

Trucks shall not travel on the mixture until compaction has been completed and the bituminous-concrete pavement surface will support traffic without measurable deformation.

3.4 PREPARATION OF AREA TO BE PAVED

3.4.1 Surface Preparation

Immediately before application of a bituminous prime coat to the aggregate base-course surface or other contact surface, loose material or other objectionable substances shall be removed.

3.4.2 Priming the Base Course Surface

A bituminous prime coat shall be uniformly applied to the prepared base course surface. Rate of application shall be within the range of 0.20 and 0.40 gallon per square yard 0.9 and 1.8 liter per square meter of surface. Temperature of the bituminous material at the time of application shall be within the range of 105 and 180 degrees F 40 and 80 degrees C.

Care shall be taken that the amount of prime coat at the junction of previous and subsequent applications is not in excess of that specified in the rate of application. Excess prime-coat material shall be squeegeed from the surface. Areas missed by the bituminous distributor shall be treated with prime-coat material by means of hand sprayers.

Following the application of prime-coat material, the surface shall be allowed to dry without being disturbed for a period of not less than 48 hours or longer as may be necessary to attain penetration into the aggregate base course and evaporation of the volatile from the bituminous material. Blotting the prime coat with fine aggregate will not be permitted.

3.4.3 Priming Other Contact Surfaces

A bituminous tack coat shall be uniformly applied to the contact surfaces of previously constructed bituminous-concrete or portland-cement concrete pavement and other similar surfaces by means of a bituminous distributor. Rate of application shall be 0.05 to 0.15 gallon per square yard 0.2 to 0.7 liter per square meter of surface. Temperature of the bituminous material at the time of application shall be 105 and 180 degrees F 40 and 80 degrees C.

Contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting the concrete pavement shall be painted with a thin, uniform coating of bituminous tack-coat material prior to the bituminous-concrete mixture being placed against such structures.

Following the application of the tack coat, the surface shall be allowed to dry until it is in a condition of tackiness to receive the bituminous-concrete mixture. Excess tack-coat material shall be squeegeed from the surface.

3.5 PLACING BITUMINOUS-CONCRETE COURSES

3.5.1 General

Bituminous-concrete mixture shall be placed on the prepared surface, uniformly spread, and struck off. Bituminous-concrete courses shall be placed in layers of approximately equal thickness except that no layer shall be more than 2 inches 50 millimeter in thickness after compaction. Courses shall be so placed that, when compacted, they will conform to the indicated grade, cross section, and thickness.

3.5.2 Paver Placing

Each paver shall be adjusted and the speed regulated so that the surface of the bituminous-concrete mixture will be smooth and, when compacted, will conform to the depths, cross sections, grades, and contours indicated.

Placing shall begin along the centerline of areas to be paved on a crowned section, at the high side of a section with a one-way slope, and in the direction of the traffic flow.

The mixture for each course shall be placed in strips not less than 10 feet 3100 millimeter wide. Progressive strip placement shall commence after rolling of the first strip. Rolling shall be extended to overlap the preceding strips. Placing the bituminous-concrete mixture shall be continuous.

Experienced shovelers and rakers shall follow each paver, adding hot bituminous-concrete mixture and raking the mixture as required to produce a course that, when completed, will conform to requirements specified.

3.5.3 Hand Placing

In areas where the use of machine spreading is not practicable, the mixture shall be spread and finished by the use of heated hand tools.

Mixture shall be dumped on approved dump boards and distributed into place from the dump boards in a uniformly loose layer of a thickness that will, when compacted, conform to the required grade and thickness. Mixture shall

be dumped no faster than it can be handled properly by the shovelers and rakers.

3.5.4 Joints

Joints shall have the same texture, density, and smoothness as other sections of the course. Joints between old and new pavements, or between successive days' work, shall be made to ensure a continuous bond between the old and new sections of the pavement.

Transverse joints in succeeding courses shall be offset at least 24 inches 600 millimeter, and the edge of the previously placed course shall be cut back to expose an even vertical surface for the full thickness of the course.

Longitudinal joints in succeeding courses shall be offset at least 6 inches 150 millimeter. When the edges of longitudinal joints are irregular or do not conform to the specifications, the edge shall be cut back to expose an even vertical surface for the full thickness of the course.

3.6 COMPACTION

3.6.1 General

Compaction shall begin as soon after placing as the bituminous-concrete mixture will bear the weight of the roller without undue displacement.

Delays in compacting the freshly spread mixture will not be permitted.

During rolling, the wheels shall be kept moist with the minimum amount of water necessary to avoid picking up the bituminous-concrete mixture.

In places not accessible to the rollers, the mixture shall be compacted with hot hand tampers.

3.6.2 Rolling Procedure

Rolling shall start longitudinally at the extreme sides of lanes and shall proceed toward the center of the pavement, except on superelevated curves. Rolling on superelevated curves shall begin on the low side and progress to the high side, overlapping on successive trips by at least one-half the width of the rear wheel of the roller.

Alternate trips of the roller shall be of slightly different lengths.

Rollers shall move at a slow but uniform speed with the drive roll or wheel nearest the paver. Speed of the rollers shall not exceed 3 miles 5 kilometer per hour for steel-wheeled rollers or 5 miles 8 kilometer per hour for pneumatic-tired rollers.

Rollers shall not be parked on the pavement.

3.6.3 Initial Rolling

Initial rolling shall immediately follow the rolling of the longitudinal joint and edges. Rollers shall be operated as close to the paver as possible without causing undue displacement.

Preliminary tests of crown, grade, and smoothness shall be made immediately

after the initial rolling.

Before the rolling is continued, deficiencies shall be corrected by adding or removing material so that the finished course will conform to the specified requirements for grade and smoothness.

3.6.4 Second Rolling

Second rolling shall follow the initial rolling as closely as possible, while the mixture is hot and in condition suitable for proper compaction.

Rolling shall be continuous (at least 3 complete coverages) after the initial rolling until the mixture has been compacted.

Causing undue displacement by turning rollers on the hot mixture will not be permitted.

3.6.5 Finish Rolling

Finish rolling shall be done while the mixture is warm enough for the removal of roller marks. Rolling shall continue until all roller marks are eliminated and the course has the specified density.

3.6.6 Patching Deficient Areas

Bituminous-concrete mixtures that become mixed with foreign material or that are defective, such as low areas or "bird-baths," shall be removed, replaced with fresh bituminous-concrete mixture to obtain the grade and smoothness required for the finished surface, and compacted to the specified density.

Pavement in deficient areas shall be removed the full thickness of the bituminous-concrete course and so cut that the sides are perpendicular and parallel to the direction of traffic and the edges are vertical. Edges shall be sprayed with bituminous tack-coat material as specified.

Skin patching an area that has been rolled will not be permitted.

3.6.7 Protection of Pavement

After final rolling, no vehicular traffic shall be permitted on the pavement until the pavement has cooled and hardened and in no case sooner than 6 hours.

3.7 ACCEPTANCE PROVISIONS

3.7.1 General

Density, surface smoothness, and thickness of completed bituminous-concrete base and surface courses shall be tested to verify compliance with the specified requirements.

3.7.2 Density and Thickness Requirements

Pavement specimens of each completed bituminous-concrete course shall be taken on the basis specified. Diameter of pavement core specimens shall be not less than 3 inches 75 millimeter, and shall be through the entire base course and surface course. Locations for the removal of pavement specimens shall be as directed by the Contracting Officer. Test holes shall be

repaired as specified.

Thickness shall not vary from the indicated thickness by not more than 1/2 inch 15 millimeter for the base course and 1/4 inch 6 millimeter for the surface course.

3.7.3 Surface Requirements

Finished surface of each bituminous-concrete course shall be tested for smoothness with a 10-foot 3100 millimeter straightedge applied parallel with, and at right angles to, the centerline of the paved area. Entire paved area shall be checked from one side to the other. Advancement along the pavement shall be in successive stages of not more than half the length of the straightedge.

Surface-course surface shall vary not more than [1/4] [7] [_____] inch millimeter from the straightedge.

Crown of each bituminous-concrete course shall be tested for conformance to the required cross section with a crown template centered on, and at right angles to, the centerline of the crown. Crown shall be checked along its entire length. Finished crown surface for each bituminous-concrete course shall vary not more than 1/4 inch 6 millimeter from the crown template.

Final surface shall have a uniform texture and shall conform to the required grade and cross section. Low or defective areas shall be immediately corrected by cutting out the faulty areas and replacing them as specified.

3.8 PAVEMENT STRIPING

3.8.1 Surface Preparation

New pavement surfaces shall be cured for [14] [_____] days before application of marking materials. Where oil or grease are present on old pavements, the affected areas shall be scrubbed with approved detergent or degreaser, and rinsed thoroughly.

3.8.2 Traffic Control

Traffic control markers shall be placed along newly painted lines to prevent damage to newly painted surfaces.

3.8.3 Application

Paint shall be applied at a rate recommended by the manufacturer, and when the air and pavement temperatures are between [40] [_____] and [95] [_____] degrees F, and the relative humidity is not higher than 85 percent at time of application.

Where reflectorized paint is specified, glass beads shall be uniformly dispensed at the rate of [6] [10] [_____] pounds per gallon of paint.

Markings shall be sharply outlined, with uniform thickness, and stripe widths shall be as indicated.

If there is a deficiency in drying of the markings, painting operations shall be discontinued until the cause of the slow drying time is determined and corrected.

If discoloration of the paint occurs due to bleeding of bituminous materials, the paint shall be applied in 2 coats.

-- End of Section --